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And

Example Templates

Public Safety and Infrastructure Workgroup

Natural Resources Workgroups

Society & Economy Workgroup

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Public Safety and Infrastructure

Public Safety

Transportation

Utilities – Public/Commercial/Private

Services

Industrial

[1] Data on quantities impacted are not available or have not been analyzed.

Resource: Ambulance & Paramedic Stations

Structures that house and maintain Ambulance & Paramedic apparatuses and may contain communication centers and ancillary equipment storage. These may or may not be co-located with Fire Stations

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Exposure:

Number and percentage of stations exposed at each inundation level.

Ambulance and Paramedic Stations							
County	Total Number	Number Inundated			Percent of Total Inundated		
		0.5m	1.0m	1.5m	0.5m	1.0m	1.5m
State	70	2	5	6	3%	7%	9%
New Castle	34	1	1	1	3%	3%	3%
Kent	15	1	2	2	7%	13%	13%
Sussex	21	0	2	3	0%	10%	14%

Fire and Rescue Stations that are exposed include: Delaware City, Leipsic, Bowers Beach, Bethany Beach Stations 1 & 2, Roxanna Ambulance Station

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Impact on Resource Based on Inundation Level:

Exposure only at Lunar High Tide: Ambulance stations ***may still fully function*** at this level of inundation. Minimal adaptation ***may be required*** to maintain full functionality.

Exposure only at High Tide: Ambulance stations ***may only have limited function*** at this level of inundation. Adaptation ***will be required*** to maintain full functionality

Exposure at Low Tide: Ambulance stations ***will not function*** based on this level of inundation. Adaptation ***will be required*** to maintain full functionality

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Additional criteria needed to fully assess impact:

Surrounding road elevations to determine accessibility to station

Floor Elevations to determine level of inundation within structures
Critical Equipment Elevations to determine exposure of ancillary equipment

Socio-Economic & Environmental Impacts:

Social: Limited or changed functionality of Ambulance & Paramedic Stations will impact response times of medical personal and thus could increase risk of loss of life.

Economics: Limited or changed functionality of Ambulance & Paramedic Stations will impact response times of medical personal and thus could increase insurance rates, health care costs. Alter governmental funding allocated to stations which is based on response times.

Environment: Limited or changed functionality of Ambulance & Paramedic Stations will impact response times of medical personal and thus could increase times to contain spills and other detrimental environmental impacts from fires, accidents or spills if injured parties need to be stabilized and transported first.

Adaptation Options:

Adaptation Support:

NATURAL RESOURCES CHAPTER OF VULNERABILITY ASSESSMENT

I. WATER RESOURCES
   a. Salinity Changes
   b. Surface Water Effects
   c. Groundwater Effects

II. WETLANDS
   a. Tidal
      i. Saltwater Tidal
      ii. Freshwater Tidal
   b. Non-tidal
      i. Emergent
      ii. Shrub
      iii. Forested
   c. Impoundments

III. BEACHES and DUNES
   a. Beach and dune
   b. Interdunal wetlands

IV. UPLAND FOREST
      i. Deciduous
      ii. Evergreen
      iii. Mixed

V. FLORA and FAUNA
   a. Animal (SGCN) Species
      i. State rare
      ii. Globally rare
      iii. Federally listed
   b. Plant Species
      i. State rare
      ii. Globally rare
      iii. Federally listed

VI. NATURAL RESOURCE CONSERVATION LANDS
   a. Natural Areas and Nature Preserve
   b. Conservation easements
   c. Local / County Parks
   d. Wildlife Refuges

        i. Prime Hook and Bombay Hook NWR
    e. State Parks/Wildlife Areas/State Forests/DNERR

VII. AGRICULTURE
    a. High Productivity Soils
    b. Preservation Districts & Conservation Easements
        i. Agricultural land preservation districts and agricultural conservation easements

AGRICULTURAL AREAS OF HIGH PRODUCTIVITY

Exposure to Sea Level Rise:

Prime Farmland: Land which has the best combination of physical and chemical characteristics for the production of crops. It has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to current farming methods. Prime farmland does not include publicly owned lands for which there is an adopted policy preventing agricultural use (USDA).

Farmland of Statewide Importance: Land other than Prime Farmland which has a good combination of physical and chemical characteristics for the production of crops. Farmlands of Statewide Importance include those that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. It does not include publicly owned lands for which there is an adopted policy preventing agricultural use (USDA).

Prime Farmland (Soils)

County	Total Acres of Prime Farmland	Total Acres Inundated			Percent of Total Acres Inundated		
		0.50m	1.0m	1.5m	0.50m	1.0m	1.5m
State	379,291	5,560	11,268	16,966	1%	3%	4%
New Castle	104,009	1,248	2,374	3,362	1%	2%	3%
Kent	141,654	1,500	3,621	5,862	1%	3%	4%
Sussex	133,628	2,812	5,274	7,742	2%	4%	6%

Source: Delaware Coastal Programs, Prime Farmland (2011) and Farmland of Statewide Importance, unpublished.

Farmland (Soils) of Statewide Importance

County	Total Acres of Farmland of Statewide Importance	Total Acres Inundated			Percent of Total Acres Inundated		
		0.50m	1.0m	1.5m	0.50m	1.0m	1.5m
State	313,837	7,004	11,431	15,395	2%	4%	5%
New Castle	43,770	1,290	1,992	2,572	3%	5%	6%
Kent	138,322	2,611	4,348	6,003	2%	3%	4%
Sussex	131,745	3,104	5,090	6,820	2%	4%	5%

Source: Delaware Coastal Programs, Prime Farmland (2011) and Farmland of Statewide Importance, unpublished.

Approximately 1% - 4% of Delaware's Prime Farmland will be exposed to sea level rise. The largest impact will be felt in Sussex County where 6% of prime farmland will be inundated at the 1.5 meter scenario. Concerning Delaware's Farmland of Statewide Importance, approximately 2% - 5% will be exposed to sea level rise. The largest impact will be felt in New Castle County where 6% of the farmland will be inundated at the 1.5 meter scenario.

Users and Uses:

Agricultural land used in Delaware range from local crop and vegetable farms to large poultry producers and food processors. Support businesses, such as grain, fertilizer, and irrigation supply businesses, also fall in the agricultural use category.

Many groups throughout Delaware benefit from the strength of the agricultural economy. State and local government agencies use funds generated by agricultural taxes to support other programs.

Fiscal Capacity:

Agriculture in Delaware is a majority private business so the fiscal capacity is variable depending on each farming operation. Federal and State government subsidies are available to give financial assistance to farmers but the majority of funding comes from banking and mortgage institutions.

The Delaware Agricultural Lands Preservation Program allows for land to be devoted only to agriculture and related uses. Currently, there are 129,163 acres in 519 Agricultural Preservation Districts and District expansions in Delaware. Out of the 129,163 acres currently in agricultural preservation districts, 307 properties encompassing approximately 64,830 acres have been permanently protected through the purchase of preservation easements for $67.4 Million (DDA).

Regulations & Policies:

Title 7 Chapter 37, Agricultural Conservation and Adjustment: The State of Delaware recognizes that the soil resources, the fertility of the land, the economic use, and the prosperity of the farming population are critical issues that affect the public interest.

Title 3 Chapter 9, Delaware Agricultural Lands Preservation Act: Allows the State of Delaware to conserve, protect, and encourage improvement of agricultural lands for the production of food and other agricultural products.

Potential Economic Impact:

Prime farmland and farmland of statewide importance are the areas of Delaware where the highest crop production rates occur. These lands are the State's economic drivers for agriculture. Concerning the

economy, net farm income was estimated at $193 million in 2009 (UD). However, sea level rise has the potential to cut into the farming income for the state. Saltwater intrusion can impact agricultural activities by decreasing crop yield, completely eliminating the capability of growing certain crops, and impacting the health of domestic livestock.

Potential Social Impact:

Many communities in Delaware developed due to relative proximity to prime farmland. The potential loss of productive agricultural fields and resulting losses in employment may cause farmers and farm workers to relocate to areas not affected by sea level rise, causing losses to the local agricultural heritage of a community.

Potential Environmental Impact:

Agriculture in Delaware often relies on irrigation which may be impacted by the intrusion of seawater pushing further up into fresh water stream and rivers. In coastal areas, the increased water withdrawal, combined with sea level rise, may increase saltwater intrusion into the ground water or aquifers. Additionally, in agricultural locations near the coast, the seaward boundary for agriculture often is the point where saltwater penetrates inland far enough to prevent crops from growing (IPCC). As sea level rises, this boundary could move farther inland causing increased amounts of farmland to become too salty for traditional crop cultivation. Once seawater has invaded to a distance beyond that is tolerable, restoration of water quality in the invaded zone is generally an expensive or ineffective proposition. (Bear, et. al.). Concerning prime farmland and farmland of state-wide importance, these soil types will lose their high production characteristics as salinity increases. The land may still allow for cultivation however, crop yields will begin to diminish well before inundation occurs.

Additional Information:

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V - FUTURE DEVELOPMENT AREAS

The Delaware Population Consortium projects that by the year 2040, Delaware will be home to 1,120,523 residents – an increase of over 225,000 persons. These projections are routinely used by State, County and municipal governments to plan how and where future residential and commercial development will occur.

Delaware encourages proactive planning for the State's future growth needs through a variety of mechanisms, including the Strategies for State Policy and Spending, implemented by the Office of State Planning Coordination. These strategies set forth guidelines and maps for where the state plans to make investments of public funds for roads, sewer, schools and other infrastructure. It also outlines those areas where the state will direct funding for investments in agriculture and natural resource preservation. The strategies incorporate the zoning and future land use desires of county and municipal governments as outlined in their comprehensive development plans. The Strategies were first approved in 1999 and were updated in 2004 and 2010. Executive Order 26 states that "All state departments and agencies shall use the Strategies document and maps as a guide to making all decisions on policy, infrastructure and other investments, and resource management"

Exposure to Sea Level Rise:

State strategy level 3 areas were used to determine exposure of future growth areas to sea level rise. Investment Level 3 areas are lands within the long-term growth plans (greater than five years) of county and municipal governments and/or are adjacent to already developed or developing areas. Some of these planned growth areas will be exposed to sea level rise under the three planning scenarios (See Table XX) and will be unsuitable for development to meet future growth needs.

Table XX: State Strategy Level 3 Areas Inundated by Sea Level Rise

	Total Acres Of land	Total Acres of Level 3 Areas Inundated			Percent of Total Inundated		
		0.50m	1.0m	1.5m	0.50m	1.0m	1.5m
State	152,001	3,907	7,777	11,178	3%	5%	7%
New Castle	43,480	428	783	1,107	1%	2%	3%
Kent	25,487	566	815	1,059	2%	3%	4%
Sussex	83,034	2,912	6,178	9,012	4%	7%	11%

***Source**: Delaware Office of State Planning Coordination, Investment Levels, Delaware State Strategies for State Policies and Spending (2010), 2010-10-01*

In New Castle County, approximately 2% of level 3 areas within the county would be inundated under the 1-meter sea level rise scenario. Generally, these are areas surrounding the towns of New Castle, Delaware City and Port Penn as well as areas along the Christina River near the I-95 corridor.

In Kent County, approximately 3% of level 3 areas within the county would be inundated under the 1-meter sea level rise scenario. Generally, these are growth areas designated by coastal towns like Bowers Beach, Leipsic and Little Creek for future growth. Fringes of land designated as level 3 adjacent to the St. Jones River, Muderkill River and Mispillion River are also exposed to future sea level rise under these scenarios.

In Sussex County, approximately 7 % of level 3 areas within the county would be inundated under the 1-meter sea level rise scenario. The coastal development patterns in Sussex County starkly contrast with Kent County's development patterns in large part because of the resort nature of coastal Sussex County. To meet the demand for homes and services near the Atlantic Coast and Inland Bays, future growth areas surround existing development around the Inland Bays. Many of these areas, particularly Angola Neck, Long Neck, and Fenwick along Route 54 will be exposed to future sea level rise. In addition, future growth zones in and around Rehoboth Beach, Lewes and Slaughter Beach will also be exposed.

Users and Uses:

The location and type of future growth areas will affect Delaware residents, persons moving to Delaware, commercial interests, businesses related to land development and construction as well as government entities.

Local and municipal officials and professional staff, with input and in some cases approval from State and Federal agencies, will be responsible for making decisions regarding locations and types of future growth areas.

Fiscal Capacity:

The Strategies for State Policies and Spending limit state investment in infrastructure such as roads, sewer, water and public facilities in Level 3 investment areas until such time as these areas are needed to accommodate growth.

Regulations & Policies:

Land use decisions are made almost exclusively at the county or municipal level, with some input from State agencies. However, the State makes decisions regarding large infrastructure projects to support new development including roads, wastewater treatment and schools.

Growth can and will likely occur within future inundation areas. Local building codes and local zoning, as well as Federal Emergency Management Agency (FEMA) regulations, will be the most important factor

for determining how resilient to inundation newly built and/or renovated structures will be and whether losses might occur in the future.

In some areas, particularly in unincorporated New Castle and Kent Counties, existing riparian buffer ordinances, floodplain ordinances, building codes and setback requirements may be adequate to allow development within future growth areas that would not put new structures at risk from inundation. For example, Kent County prohibits subdivision of flood prone areas identified on the Flood Insurance Rate Maps. In addition, construction within the floodplain is subject to more stringent construction standards in Kent County (Kent County, 2007). Unincorporated areas within Sussex County are subject to less stringent requirements for development around tidal waters and within or near floodplains, however, structures within floodplains must be built to FEMA flood insurance standards.

Potential Economic Impact:

Losses of land within dedicated future growth areas could result in a reduction in potential new tax base generated by commercial enterprises and in some cases residential properties. However, recent studies have indicated that tax generation for new properties does not cover the cost of providing services indicating that loss of future residential tax revenue in these may not be a large consideration for local governments. In addition, development within future growth zones that have the potential to be inundated by future sea level rise may be limited by the willingness of purchasers to assume risk, and it may be made more expensive if local communities enact stricter zoning or building codes.

New development in areas that may be exposed to future sea level rise may create the expectation that government assistance for infrastructure improvements, flood control and/or buy-outs will be made available if necessary. The cost of these actions could have significant future cost to government entities. A recent report that assessed and proposed solutions for flooding problems in Bowers Beach estimated a total cost of over $469,000 (KCI 2011) for implementation of these solutions. This cost does not include the larger cost of state-provided sand for Bowers Beach for the past 50 years, a protective strategy necessitated by shoreline erosion and long term relative sea level rise, nor does it include costs for flood mitigation at an increased sea level.

It is important to note that costs to individuals and government entities from flood mitigation projects and relocation or elevation of structures conducted as a response to sea level rise will vary depending on individual response to the rising tides. Many people residing or doing business within an inundation zone will accept a certain amount of risk and inconvenience; some may choose to relocate or raise their structures before inundation becomes problematic.

Potential Social Impact:

Small coastal towns along the Delaware Bay like Bowers Beach, Leipsic and Slaughter Beach may choose to limit the extent of their future growth areas, or change the location of their future growth areas based upon these sea level rise scenarios. If unable to find suitable areas to direct their growth, existing commercial and residential areas could fail to meet the needs of nearby residents. However,

populations in these towns are small and their commercial areas are limited indicating that major disruption to services region or state-wide should be a minor concern.

Loss of land due to inundation without adequate planning or nearby land to rebuild could result in abandonment of Delaware's small coastal towns, or a reduction in the quality of life within them. In addition, the inundation scenarios indicate that both existing development and future development zones around Delaware's Inland Bays are significantly impacted by future sea level rise scenarios. Quality of life in and around the Inland Bays may be affected as a result, but it is important to note that the timeline for anticipated impacts is quite long and may allow adequate time for adjustments in development areas.

Potential Environmental Impact:

Environmental impacts will vary depending upon how land use planners and developers choose to respond, and whether development is discouraged (whether by government action or personal risk tolerance) within potential future inundation zones. Development within these zones could result in a reduced opportunity for land preservation that would allow for tidal marshes to naturally migrate landward and could necessitate the hardening of natural shorelines, among others.

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